IN THE

ARIZONA COURT OF APPEALS

DIVISION ONE

STATE OF ARIZONA ex rel. WILLIAM G. MONTGOMERY, Maricopa County Attorney, *Petitioner*,

v.

THE HONORABLE PHEMONIA L. MILLER, Commissioner of the SUPERIOR COURT OF THE STATE OF ARIZONA, in and for the County of MARICOPA, *Respondent Commissioner,*

SUZANNE RACQUEL MADRID, *Real Party in Interest*

No. 1 CA-SA 13-0132
FILED 3-28-2014

Petition for Special Action from the Superior Court in Maricopa County
No. CR2009-169025-001 DT
The Honorable Phemonia L. Miller, Commissioner

JURISDICTION ACCEPTED; RELIEF GRANTED

COUNSEL

Maricopa County Attorney's Office, Phoenix
By Lisa Marie Martin
Counsel for Petitioner

Law Offices of Neal W. Bassett, Phoenix
By Neal W. Bassett

And

Shell & Nermyr PLLC, Chandler
By Mark A. Nermyr
Co-Counsel for Real Party in Interest

OPINION

Presiding Judge Andrew W. Gould delivered the opinion of the Court, in which Judge Margaret H. Downie and Judge Patricia A. Orozco joined.

G O U L D, Judge:

¶1 The State seeks special action relief from the trial court's order granting Defendant's motion in limine. The trial court's order precluded the State's expert from testifying that, based on his retrograde extrapolation calculation, Defendant's blood alcohol concentration (BAC) was above the legal limit within two hours of driving. Because we conclude the expert's testimony is admissible under Arizona Rule of Evidence 702, we accept jurisdiction and grant relief.

Facts and Procedural Background

¶2 In May 2009, Suzanne Raquel Madrid ("Defendant") was stopped by the police on suspicion of driving under the influence of alcohol. The traffic stop occurred at 2:20 a.m. Defendant was arrested, and at 6:15 a.m. her blood was drawn. Defendant's blood test showed her BAC was .127.

¶3 Defendant was eventually indicted on two counts of aggravated driving while under the influence of alcohol ("DUI"). Count One charged Defendant with driving under the influence of alcohol while her ability to drive was impaired by alcohol "to the slightest degree." Arizona Revised Statutes ("A.R.S.") section 28-1381(A)(1) (2012).[1] Count

---

[1] A.R.S. § 28-1381(A)(1) states, in relevant part, "It is unlawful for a person to drive a vehicle or be in actual physical control of a vehicle in this

Two charged Defendant with driving while her BAC was .08 or greater within two hours of driving. A.R.S. § 28-1381(A)(2) (2012).[2]

¶4 Because Defendant's blood was drawn almost four hours after she was stopped by the police, the State did not have a blood test showing her BAC within two hours of driving. A.R.S. § 28-1381(A)(2). In order to prove what Defendant's BAC would have been within two hours of driving, the State was required to perform a retrograde extrapolation. *See State v. Claybrook*, 193 Ariz. 588, 590, ¶ 14, 975 P.2d 1101, 1103 (App. 1998) (stating that "[w]hen a defendant's BAC test does not occur within two hours of driving . . . the State may still meet its burden of proving that the defendant had a BAC" above the legal limit within two hours of driving by using retrograde extrapolation).[3]

¶5 A retrograde, or retroactive extrapolation, is a method by which a person's BAC at an earlier point in time is calculated based on his BAC from a later blood test. *Claybrook*, 193 Ariz. at 590, ¶¶ 14-15, 975 P.2d at 1103; *Ring*, 141 Ariz. at 69, 685 P.2d at 134. Here, the State's expert

---

state . . . while under the influence of intoxicating liquor . . . if the person is impaired to the slightest degree." Here, Defendant was charged with aggravated DUI, a class four felony, because her "driver['s] license or privilege to drive [was] suspended, canceled, revoked or refused . . ." or restricted at the time of the offense. A.R.S. § 13-1383(A)(1).

[2] A.R.S. § 28-1381(A)(2) states, in relevant part, "It is unlawful for a person to drive a vehicle or be in actual physical control of a vehicle in this state . . . if the person has an alcohol concentration of 0.08 or more within two hours of driving or being in actual physical control of the vehicle . . ."

[3] Under the current version of A.R.S. § 28-1381(A)(2), no impairment from alcohol need be shown if the defendant's BAC is 0.08 or more within two hours of driving. Prior to 1990, our statute required the State to prove a defendant's BAC was above the legal limit at the time of driving. *See* A.R.S. § 28-692(A)(2) (1988); *Desmond v. State*, 161 Ariz. 522, 528, 779 P.2d 1261, 1267 (1989); *Ring v. Taylor*, 141 Ariz. 56, 69, 685 P.2d 121, 134 (App. 1984). Under this prior version of the statute, the State was required to perform a retrograde extrapolation to the time of driving. *Desmond*, 161 Ariz. at 528-29, 779 P.2d at 1267-68. The statute was amended in 1990, requiring the State to establish a defendant's BAC within two hours of driving. *Williams v. Thude*, 180 Ariz. 531, 536 n.2, 885 P.2d 1096, 1101 n.2 (App. 1994); Laws 1990, Ch. 375, § 8.

planned to use retrograde extrapolation to calculate Defendant's blood alcohol content within two hours of the stop based on the blood draw taken at 6:15 a.m.

¶6 Prior to trial, Defendant filed a motion requesting an evidentiary hearing to determine the admissibility of the State's proffered retrograde extrapolation testimony. The trial court held an evidentiary hearing on the motion, during which the State's expert, John Musselman, and Defendant's expert, Chester Flaxmayer, testified about the science of retrograde extrapolation.

¶7 Both Musselman and Flaxmayer agreed on the validity of the basic science underlying retrograde extrapolation. The experts testified that when individuals drink alcohol, it is absorbed into their blood stream. After they stop drinking, their blood alcohol concentration will continue to rise until it reaches a "peak," or maximum concentration in their blood. After a person's BAC reaches its peak, it will then begin to fall as their body eliminates alcohol faster than it absorbs it.

¶8 Musselman and Flaxmayer agreed that there are two key factors in making a retrograde calculation: (1) the amount of time it takes a person to fully absorb alcohol and reach a "peak" BAC, and (2) the rate at which a person eliminates alcohol from his body. Flaxmayer agreed that the alcohol elimination rate used by Musselman in his retrograde analysis was scientifically valid.[4] Both experts also agreed that in order to make a valid retrograde analysis, an individual must have been "fully absorbed," or have reached a peak BAC at the relevant time period.[5] Otherwise, the retrograde analysis may overestimate a person's BAC. Finally, both Musselman and Flaxmayer testified that a number of variables affect how long it takes an individual to reach their peak BAC, including drinking history (time of last drink, how much they drank and over what time period, what type of alcohol they drank, whether they are a heavy or social drinker), eating history (when they ate, what they ate and how

[4] Musselman testified that the general population eliminates alcohol at a rate between .09 to .29 mg/mL per hour, and that he used a range of .08 to .25 mg/mL per hour in his retrograde calculation.

[5] Musselman and Flaxmayer agreed that a valid retrograde analysis can also be performed if a person has reached a "plateau" where their absorption rate and elimination rate are in equilibrium, and their BAC is no longer rising.

much food they consumed before they were stopped), and personal characteristics (height, weight, gender).

¶9 One area addressed by the experts was the application of retrograde extrapolation to the "time of test" and the "time of driving." The phrase "time of driving" refers to the last point in time when a defendant is driving or in actual physical control of a vehicle. Kurt M. Dubowski, Article: *Time-of-Test DUI Laws vs. BAC Extrapolation*, December 2006, pp. 3-13 (Presented at The Robert F. Borkenstein Course on Alcohol and Highway Safety, Indiana University/Bloomington). In this case, the time of driving was 2:20 a.m., when Defendant was stopped by the police. The phrase "time of test" refers to a defendant's BAC measured at a specific time interval after the time of driving, e.g., after the time of the traffic stop/arrest. *Id*. In many states, this time interval is set by statute. *Id*. Such statutes are referred to as "per se" DUI statutes, because a defendant is presumed to be impaired from alcohol if his BAC is above the legal limit at the specified time interval. *Id*. at 3. The statutory interval for a per se DUI offense in Arizona is designated as "within two hours of driving or being in actual physical control" of a vehicle. A.R.S. § 28-1381(A)(2). Here, the time of the test refers to Defendant's BAC within two hours of driving, or immediately before 4:20 a.m.

¶10 Musselman agreed with Flaxmayer that a scientifically valid retrograde analysis could not be related back to Defendant's time of driving without knowing what she ate and drank, and when, before she was arrested. However, Musselman testified that a valid retrograde analysis could be performed to within two hours of Defendant's driving even without information concerning Defendant's eating and drinking history. Musselman's opinion was based on three assumptions: (1) Defendant consumed no alcohol or food in the two hour interval after she was stopped; (2) the average person is fully absorbed and reaches peak BAC within two hours after consuming their last drink, which in this case would have been no later than the time of the traffic stop; and (3) a range of BAC is used rather than a specific value. Based on these assumptions, Musselman testified that Defendant's BAC within two hours of driving was .127 to .177, well above the legal limit of .08.

¶11 Flaxmayer testified that a valid retrograde analysis could not be performed to within two hours of driving without knowing Defendant's eating and drinking history prior to the traffic stop. He opined that it is not reasonable to assume the average person reaches peak BAC within two hours of consuming their last drink, because "large numbers of individuals" do not reach peak BAC within this time period.

Flaxmayer stated that it is critical to know a person's eating and drinking history in order to determine when a person reaches his peak BAC and that any assumptions about a person's peak BAC without this information are speculative.

¶12 The trial court granted Defendant's motion in limine, finding that Musselman's retrograde analysis was not reliable under the "*Daubert* standards" set forth in "amended Arizona Rules of Evidence 702." The trial court found that Musselman failed to account for important unknown variables affecting Defendant's BAC, such as Defendant's eating and drinking history before the traffic stop. The trial court also relied on literature authored by Dr. Alan Wayne Jones for the proposition that alcohol absorption differs among individuals and that many factors play a role in when an individual's "peak BAC" occurs. It also found persuasive *State v. Armstrong*, 267 P.3d 777 (Nev. 2011), in which the Nevada Supreme Court held that a retrograde extrapolation is unreliable if it is insufficiently tied to important variables affecting the calculation, such as the drinking and eating history of a defendant. The trial court concluded that the State's retrograde analysis was "unreliable and highly prejudicial," and "[t]hough relevant, the probative value is outweighed by the prejudicial effect." Based on these findings, the trial court issued an order "precluding the retrograde extrapolation and any testimony that the defendant was above the legal limit within two hours of driving."

¶13 The State filed this special action challenging the trial court's order and requesting a stay of the jury trial. We previously granted the State's stay request.

Jurisdiction

¶14 We accept jurisdiction of this special action because the State has no immediate right to appeal the trial court's preclusion order; as a result, the State has no "equally plain, speedy, and adequate remedy by appeal." Ariz. R. P. Spec. Act. 1(a); *State v. Bernstein*, 234 Ariz. 89, 93, ¶¶ 6-7, 317 P.3d 630, 634 (App. 2014) (State has no immediate right to appeal from an order precluding evidence at trial); *State v. Bejarano*, 219 Ariz. 518, 522, ¶ 11, 200 P.3d 1015, 1019 (App. 2008) (same). In addition, this case involves issues that are of statewide importance: the interpretation of Arizona Rule of Evidence 702 and the admissibility of retrograde extrapolation evidence. *BT Capital, LLC v. TD Serv. Co. of Ariz.*, 229 Ariz. 299, 300, ¶ 7, 275 P.3d 598, 599 (2012) (stating that appellate courts will accept special action jurisdiction on issues of statewide importance); *Bernstein*, 234 Ariz. at 93-94, ¶¶ 6, 9, 317 P.3d at 634-35 (stating that

interpretation of Arizona Evidence Rule 702 as amended January 1, 2012 involves an issue of statewide importance).

Standard of Review

¶15 We review the interpretation of court rules de novo, and a trial court's decision to admit or preclude expert testimony for an abuse of discretion. *General Electric Co. v. Joiner*, 522 U.S. 136, 139 (1997); *Bernstein*, 234 Ariz. at 94, ¶ 10, 317 P.3d at 635. An appellate court "will not disturb a trial court's rulings on the admission or exclusion of evidence unless [the court] finds a clear abuse of discretion and resulting prejudice, or finds that the trial court misapplied the law." *Lohmeier v. Hammer*, 214 Ariz. 57, 61, ¶ 7, 148 P.3d 101, 105 (App. 2006).

Discussion

¶16 The State contends the trial court abused its discretion in precluding the State's expert witness testimony. The State argues that the retrograde extrapolation methodology used by its expert is scientifically valid and reliable, and that the trial court abused its role as gatekeeper under Arizona Rule of Evidence 702 by precluding its expert's testimony. Defendant, on the other hand, contends the court properly precluded the State's expert testimony because his methodology was scientifically invalid and unreliable.

I. Rule 702 and *Daubert*

¶17 Prior to 2010, Arizona's standard for the admissibility of scientific expert testimony was the general acceptance test set forth in *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923). *Logerquist v. McVey*, 196 Ariz. 470, 1 P.3d 113 (2000). Effective January 1, 2012, the Arizona Supreme Court amended Arizona Rule of Evidence 702 and adopted Federal Rule of Evidence 702, which embodies the principles set forth in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993). Ariz. R. Evid. 702, comment to 2012 amendment; Fed. R. Evid. 702, advisory committee's notes, 2000 amendments. The amended version of Arizona Rule of Evidence 702 states:

> A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if:

(a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;

(b) the testimony is based on sufficient facts or data;

(c) the testimony is the product of reliable principles and methods; and

(d) the expert has reliably applied the principles and methods to the facts of the case.

¶18 Because Arizona Rule of Evidence 702 is now identical to Federal Rule of Evidence 702, we may look to the federal advisory committee notes for guidance in interpreting the Arizona rule. *Bernstein*, 234 Ariz. at 95, ¶ 11, 317 P.3d at 636; *Ariz. State Hosp./Ariz. Cmty. Protection and Treatment Cntr. v. Klein*, 231 Ariz. 467, 473, ¶ 26, 296 P.3d 1003, 1009 (App. 2013). In addition, federal decisions interpreting Federal Rule 702 "are persuasive but not binding" authority in interpreting Arizona Rule of Evidence 702. *Bernstein*, 234 Ariz. at 95, ¶ 11, 317 P.3d at 636 (internal citations omitted); *Klein*, 231 Ariz. at 473, ¶ 26, 296 P.3d at 1009.

¶19 Like its federal counterpart, Arizona Rule of Evidence 702 provides that a trial judge serves as a "gatekeeper" who makes a preliminary assessment as to whether the proposed expert testimony is relevant and reliable. Ariz. R. Evid. 702, comment to 2012 amendment. *See* Fed. R. Evid. 702, advisory committee's notes, 2000 amendments; *Daubert*, 509 U.S. at 597; *Kumho Tire Co., Ltd. v. Carmichael*, 526 U.S. 137 (1999) (holding that a judge's gatekeeping function under *Daubert* applies to all types of expert testimony, not just scientific testimony). As a result, the party seeking to admit expert testimony must prove, by a preponderance of the evidence, that the testimony is both relevant and reliable. *Daubert*, 509 U.S. at 592 & n.10; *Bernstein*, 234 Ariz. at 94, ¶ 10, 317 P.3d at 635.

¶20 In evaluating admissibility, courts must remain cognizant of the separate functions of judge and jury. The court's role as gatekeeper does not supplant or replace the adversary system. Ariz. R. Evid. 702, comment to 2012 amendment. "Where there is contradictory, but reliable, expert testimony, it is the province of the jury to determine the weight and credibility of the testimony" and to decide between "competing methodologies within a field of expertise." *Id.*; *see also Heller v. Shaw Industries, Inc.*, 167 F.3d 146, 152 (3rd Cir. 1999) (expert testimony shall not be excluded because the expert uses one test in lieu of another, when both

tests are accepted in the field and reach reliable results). Moreover, "cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible [expert] evidence." *Heller*, 167 F.3d at 152.

¶21 The initial consideration under amended Rule 702 is whether the proffered expert is qualified to testify about a particular issue. Ariz. R. Evid. 702. Subsection (a) of amended Rule 702 primarily relates to relevancy, or what *Daubert* described as "fit." *Daubert,* 509 U.S. at 591. To be admissible, expert testimony must assist the trier of fact in understanding the evidence or a fact in issue. "Expert testimony which does not relate to any issue in the case is not relevant and, ergo, non-helpful." *Daubert*, 509 U.S. at 591 (internal citations omitted).

¶22 Under Rule 702, subsection (b), the court examines whether the expert obtained enough information or data to make the proffered opinion reliable. *U.S. v. Crabbe*, 556 F. Supp. 2d 1217, 1223 (D. Colo. 2008). The assessment of the sufficiency of the facts and data is a quantitative, not qualitative analysis. Fed. R. Evid. 702, advisory committee's notes, 2000 amendments; *cf. Crabbe*, 556 F. Supp. 2d at 1228 (in prosecution of company owners for tax evasion, government expert's testimony that owners understated employees' wages in their tax returns and filings was not reliable under Rule 702 because sample of wages paid to agency's employees "was not sufficiently large or diverse enough to permit [expert's] methodology to reliably model the accuracy of the information"). Thus, the facts or data underlying an expert's testimony may include inadmissible evidence, hypothetical facts, and other experts' opinions. Fed. R. Evid. 702, advisory committee's notes, 2000 amendments.

¶23 Subsection (c) of Rule 702 requires an expert's testimony to be based on "reliable principles and methods." Under this requirement, an expert must be able to explain how his methods, reasoning and opinions are based on "an accepted body of learning or experience." Fed. R. Evid. 702, advisory committee's notes, 2000 amendments. *See Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 43 F.3d 1311, 1319 n.11 (9th Cir. 1995) ("*Daubert II*") ("[T]he party proffering the evidence must explain the expert's methodology and demonstrate in some objectively verifiable way that the expert has both chosen a reliable scientific method and followed it faithfully."). While the expert's methodology must be based on more than speculation, its reliability need not be established to a degree of scientific certainty. *Daubert*, 509 U.S. at 590.

¶24 To assist courts in evaluating the reliability of expert testimony, *Daubert* set forth a non-exclusive list of factors. *Daubert,* 509 U.S. at 593. The specific factors articulated by *Daubert* are: (1) whether the expert's theory or technique can be or has been tested; (2) whether the theory or technique has been subjected to peer review and publication; (3) whether the technique or theory is generally accepted within the relevant scientific community; (4) the known or potential rate of error of the technique or theory when applied; and (5) the existence and maintenance of standards controlling application of the technique. *Id.* at 593-94.

¶25 No single *Daubert* factor is dispositive of the reliability of an expert's testimony, and not all of the *Daubert* factors will apply to "all experts or in every case." *Kuhmo Tire*, 526 U.S. at 141-42, 152; Fed. R. Evid. 702, advisory committee's notes, 2000 amendments; *Bernstein*, 234 Ariz. at 95, ¶12, 317 P.3d at 636; *see e.g., Tyus v. Urban Search Management*, 102 F.3d 256, 263 (7th Cir. 1996) (stating that the *Daubert* factors did not precisely apply to the proffered sociologist's expert testimony). Moreover, courts since *Daubert* have identified other factors for judges to consider in determining reliability, including whether: (1) the expert's testimony is prepared solely in anticipation of litigation, or is based on independent research; (2) the expert's field of expertise/discipline is known to produce reliable results; (3) other courts have determined that the expert's methodology is reliable; and (4) non-judicial uses for the expert's methodology/science. Fed. R. Evid. 702, advisory committee's notes, 2000 amendments; *Kuhmo Tire*, 526 U.S. at 152; *Oddi v. Ford Motor Co.*, 234 F.3d 136, 156 (3rd Cir. 2000); *Daubert II*, 43 F.3d at 1317.

¶26 Finally, subsection (d) of Rule 702 requires an expert to reliably apply "the principles and methods to the facts of the case." Ariz. R. Evid. 702(d). As the United States Supreme Court recognized in *Joiner*, "conclusions and methodology are not entirely distinct from one another," and "[a] court may conclude that there is simply too great an analytical gap between the data and the opinion offered." *Joiner,* 522 U.S. at 146. Stated another way, the court must determine "[w]hether the expert has unjustifiably extrapolated from an accepted premise to an unfounded conclusion." Fed. R. Evid. 702, advisory committee's notes, 2000 amendments.

¶27 In assessing the reliability of an expert's conclusions and opinions under Rule 702(d), courts have considered a variety of factors, including whether: (1) the expert employs the same care as a litigation expert as he would in his regular professional work outside the courtroom; (2) the expert has accounted for obvious alternative

explanations, and (3) the expert's opinion adequately accounts for available data and unknown variables. *Crabbe*, 556 F. Supp. 2d at 1223-24; Fed. R. Evid. 702, advisory committee's notes, 2000 amendments; *see Kumho Tire*, 526 U.S. at 152 (the trial court must make certain the expert employs "the same level of intellectual rigor" in the courtroom as in practice); *Sheehan v. Daily Racing Form, Inc.*, 104 F.3d 940, 942 (7th Cir. 1997) (stating that expert statistician's opinion in age discrimination case was not admissible under *Daubert* standard where the expert used standard statistical methods to show a correlation between age and the employer's decision to retain or discharge employees, but failed to adjust his statistical analysis by accounting for other variables, such as an employee's computer skills, that would have a bearing on the employer's retention/discharge decisions); *Claar v. Burlington N.R.R.*, 29 F.3d 499, 502 (9th Cir. 1994) (testimony excluded when expert failed to consider obvious alternative causes for the plaintiff's ailments).

II. Analysis

¶28 There is no contention in this case that the State's expert lacked the qualifications to render an opinion regarding Defendant's BAC using retrograde extrapolation. In addition, it is undisputed that Musselman's testimony is relevant. As the trial court noted, Musselman's retrograde analysis would assist the jury in determining whether Defendant had a BAC above the legal limit (.08) within two hours of driving, an element of the offense as alleged in Count Two. A.R.S. § 28-1381(A)(2). *See supra,* at ¶ 12.

¶29 Moreover, while Defendant's contention that Musselman based his opinion on insufficient facts (e.g., concerning her eating and drinking history) arguably falls under Rule 702(b), subsection (b) is not, under the facts of this case, the proper rule to assess the reliability of his opinion. Rule 702(b) examines the quantity of information possessed by an expert, not the reliability or admissibility of the information itself. *See supra,* at ¶ 22. Here, Musselman possessed sufficient information to perform a retrograde extrapolation based on a combination of known variables (Defendant's time of driving and her BAC results), assumptions about when Defendant reached her peak BAC (within two hours of driving), and standard alcohol elimination rates.

¶30 The core dispute in this case is the reliability of Musselman's methodology and opinions under Arizona Rules of Evidence 702(c) and (d). Defendant contends, and the trial court agreed, that Musselman's retrograde extrapolation to within two hours of driving is unreliable

because (1) it is based on the faulty assumption that Defendant reached her peak BAC within two hours of driving and (2) Musselman could not perform a valid retrograde analysis without Defendant's drinking and eating history.

A. Rule 702(c) Factors

1. Testing

¶31 The first *Daubert* factor, "testability," focuses on whether a method or theory "can be (or has been) tested." *Daubert*, 509 U.S. at 593; *see United States v. Bonds*, 12 F.3d 540, 559 (6th Cir. 1993). The inquiry is "whether the expert's theory can be challenged in some objective sense, or whether it is instead simply a subjective, conclusory approach that cannot reasonably" be tested to determine its reliability. Fed R. Evid. 702 advisory committee's notes, 2000 amendments; *see, e.g.*, *United States v. Mitchell*, 365 F.3d 215, 235 (3rd Cir. 2004) (explaining that the hypothesis "all crows are black" is testable because a white crow could be found, whereas a clairvoyant's statement that he communicates with the dead is not testable because there is no way for the dead to claim otherwise).

¶32 In this case, the issue of testing focuses on Musselman's assumption that the average person reaches his peak BAC within two hours of driving. This assumption can be and has been tested. Musselman testified that he has participated in workshops testing the absorption rates of individuals "dosed" with alcohol. In addition, Musselman testified about numerous studies and tests that have been conducted concerning absorption rates.

2. Peer Review and Publication

¶33 The second *Daubert* factor addresses whether a theory or technique has been subjected to peer review and publication. *Daubert*, 509 U.S. at 593. *Daubert* noted that "submission to the scrutiny of the scientific community is a component of 'good science,' in part because it increases the likelihood that substantive flaws in methodology will be detected." *Daubert*, 509 U.S. at 593. Under this factor, it is important to recognize that flaws in a methodology "uncovered by peer review do not necessarily equate to a lack of scientific validity," and may be relevant to "the weight, not the admissibility, of the evidence." *Bonds*, 12 F.3d at 559. Rather, "peer review and publication should be viewed as evidence that the theory and methodology are scientific knowledge capable of being scrutinized by the scientific community." *Id.*

¶34 The *Daubert* court was cognizant of the fact that publication is not the *sine qua non* of admissibility of expert testimony, as there are some instances in which "well-grounded" but novel theories will not have been published. *Daubert*, 509 U.S. at 593. *See also Kannankeril v. Terminix Int'l. Inc.*, 128 F.3d 802, 809 (3rd Cir. 1997) (holding that peer review or publication are not necessary conditions of reliability when an expert's opinion is supported by "widely accepted scientific knowledge"). In addition, courts should take into account that some methods or theories are of limited public interest, and are therefore less likely to be published. *Bonds*, 12 F.3d at 559.

¶35 Here, Musselman testified that his methodology of performing retrograde extrapolation calculations based on average absorption rates has been peer reviewed in several scholarly journals. In addition, the State submitted several peer reviewed publications discussing the use of average absorption rates in performing retrograde extrapolations.

3. General Acceptance

¶36 The next *Daubert* factor is general acceptance within the relevant scientific community. "Widespread acceptance can be an important factor in ruling particular evidence admissible, and 'a known technique which has been able to attract only minimal support within the community' may properly be viewed with skepticism." *Daubert*, 509 U.S. at 594 (internal citations omitted). The absence of a consensus or acceptance by a majority of the relevant scientific community does not necessarily rule out general acceptance, as in some instances there may be several different theories, all of which are generally accepted. *Bonds*, 12 F.3d at 562. Moreover, substantial criticism of a particular theory does not mean the theory or technique lacks general acceptance. *Id.* "Only when a theory or procedure does not have the acceptance of most of the pertinent scientific community, and in fact a substantial part of the scientific community disfavors the principle or procedure, will it not be generally accepted." *Id.* (citing *Novak v. United States*, 865 F.2d 718, 725 (6th Cir. 1989)).

¶37 The State presented evidence that Musselman's methodology has been generally accepted within the relevant scientific community. Musselman testified that several studies and scholarly publications support his opinion that the average person reaches peak BAC within two hours of their last drink. In addition, the State presented several articles in support of Musselman's testimony. For example, the

State presented publications by Dr. Kurt Dubowski and Dr. Alan Jones, both of whom were cited by Flaxmayer and Musselman as well-recognized experts in the field of retrograde extrapolation, as support for Musselman's claim that his methodology was generally accepted in the relevant scientific community.[6]

¶38 While the record shows arguable flaws in Musselman's methodology, and disagreement in the scientific community as to whether Musselman's method is the most accurate method to perform a retrograde analysis, we conclude that his methodology is generally accepted as valid in the relevant scientific community.

4. Rate of Error

¶39 The fourth *Daubert* factor, rate of error, examines whether an expert's methodology can be objectively evaluated for known or potential error rates, and whether the rate of error is acceptable in the relevant scientific community. *Daubert*, 509 U.S. at 594; *Bonds*, 12 F.3d at 560.

---

[6] Dubowski and Jones state that retrograde analysis is valid based on the time of test, because unlike a time of driving analysis, a time of test analysis measures a person's peak BAC following a time interval where they have not consumed any food or alcohol. *See* Dubowski, *Time-of-Test DUI Laws vs. BAC Extrapolation,* p. 28 ("I join in and support the position of the NSC/CAOD Subcommittee on Alcohol Technology, Pharmacology, and Toxicology, which advocates adoption of Time-of-Test DUI laws and found them to be scientifically sound and supported by the scientific literature."); Alan W. Jones, Article: *Peak Blood-Ethanol Concentration and the Time of Its Occurrence after Rapid Drinking on an Empty Stomach*, 36 J. Forensic Science 376, 384 (1991) ("The status of ethanol absorption in drunk drivers at the time of the offense is a more difficult question to tackle. In practice, it will depend on such circumstances as the previous drinking spree – the duration and quantities consumed – and the time lapse from the end of drinking to the time of arrest . . . speculation about the status of alcohol absorption in drunk drivers can be avoided by statutory definition of the analytical result *at the time of the test as the relevant figure* for prosecution. This approach is highly recommended when per se statutory limits of alcohol concentration are enforced.") (emphasis added).

¶40 In the instant case, the potential rate of error for Musselman's retrograde analysis is dependent upon the accuracy of his assumption that Defendant, like the average person, reached her peak BAC within two hours of driving. Flaxmayer testified that this assumption was too speculative. According to Flaxmayer, "there are a large number of individuals who haven't reached" their peak BAC within a two hour period, and that the relevant literature states that a valid retrograde analysis cannot be performed without knowing a person's drinking and eating history.

¶41 Musselman, however, cited several studies showing that most people reach their peak BAC within two hours of their last drink. For example, Musselman cited a study by Jones and Neri showing that 87.5% (14 of 16) of participants reached peak BAC within two hours of their last drink. In addition, the State presented evidence from another study by Jones showing the absorption rates for 1000 participants on an empty stomach. *See* Jones, *supra* note 6, at 376. The results of the tests showed that 77% of the participants reached peak BAC within 0-45 minutes of drinking and 92% reached peak BAC within 0-75 minutes of drinking. *Id*. at 378-79. In his study, Jones also references another study where 81% of the participants reached peak BAC within 30 minutes of drinking. *Id.* at 383. Based on these and other studies, Musselman testified that while some persons can take more than two hours to reach peak BAC, these individuals are "outliers," and do not reflect the absorption rates for the typical individual.

¶42 Flaxmayer's testimony partially corroborated Musselman's on the issue of average absorption rates. Flaxmayer testified that based on the studies he had reviewed, the average person on an empty stomach reaches peak BAC in 50-51 minutes, with "one person" reaching peak BAC in 14 minutes, and "at least one person [taking] 138 minutes." Flaxmayer testified that the average person who has consumed one pound of food will reach peak BAC within two hours, with the range being anywhere from 30 minutes to three hours. Finally, Flaxmayer testified that a person eating a heavy, 2000 calorie meal will average approximately three hours to reach his peak, with a range of 45 minutes to over four hours.

¶43 Musselman accounts for the potential rate of error in his methodology in a number of ways. First, he relies upon a conservative peak absorption rate of two hours, rather than the average of 30 minutes to an hour, to account for the lack of information about Defendant's last meal. *See United States v. Tsosie*, 791 F. Supp. 2d 1099, 1115-16 (D. N.M.

2011) (expert's assumption that defendant was fully absorbed within two hours of driving was a reasonable assumption to account for expert's lack of information about defendant's last meal); *Commonwealth v. Senior*, 744 N.E. 2d 614, 619-20 (Mass. 2001) (same). Second, Musselman accounted for the lack of information regarding Defendant's drinking history by using a conservative alcohol elimination rate. *Tsosie*, 791 F. Supp. 2d at 1115-16 (expert's assumption that the "general population eliminates alcohol at a rate between .01 and .03 mg/mL/h" was a reasonable assumption to account for expert's lack of information about defendant's drinking history); *Senior*, 744 N.E. 2d at 619 (same). Using this conservative elimination rate, Musselman calculated that the low end of Defendant's BAC range within two hours of driving would have been .143. Musselman, however, took this conservative elimination rate even further, using Defendant's actual BAC of .127 approximately four hours after driving as the low end of Defendant's range. Finally, to further account for variations in Defendant's eating and drinking history, Musselman did not provide a specific value for Defendant's BAC, but rather provided a range of values. *Tsosie*, 791 F. Supp. 2d at 1115-16 (range of values for BAC is scientifically valid where expert relies upon assumptions as to average absorption and elimination rates); *Senior*, 744 N.E. 2d at 620 (same).

¶44 Based on the foregoing, we conclude Musselman's methodology reliably accounted for the potential rate of error in his retrograde analysis.

5. Professional Standards

¶45 The fifth *Daubert* factor inquires whether there are universal standards that govern the application of a technique or method. *Daubert*, 509 U.S. at 594. Maintenance of industry standards is a strong factor in favor of admissibility. *United States v. Monteiro*, 407 F. Supp. 2d 351, 369 (D. Mass. 2006). However, "[t]he lack of a universal standard [for application of a technique] is troubling but not fatal under *Daubert/Kumho* because a court may admit well-founded testimony based on specialized training and experience." *Id.* at 371.

¶46 While Defendant contests the accuracy of Musselman's retrograde calculation, both Musselman and Flaxmayer agreed on the validity and standard use of the basic science underlying retrograde analysis. *See supra*, at ¶ 7. Moreover, both experts agreed that some accepted standards, such as average elimination rates, are used in retrograde extrapolation. The record also reflects that several studies have

produced standards and guidelines for making a retrograde calculation. *See supra*, ¶¶ 7-8, 37, 41-43. Accordingly, we conclude that there are general scientific standards that govern the use of retrograde extrapolation.

6. Independent Studies/Non-Judicial Uses

¶47 In addition to the *Daubert* factors, courts may also consider whether an expert developed his opinion based on independent research, or whether the expert developed his opinion "expressly for purposes of testifying." *Daubert II*, 43 F.3d at 1317; *see* Fed. R. Evid. 702, advisory committee's notes, 2000 amendments. The focus of this factor is whether legitimate, independent research has been conducted in an area, or whether the expert's methodology and opinions have solely been prepared to provide expert testimony for the courtroom. *Daubert II*, 43 F.3d at 1317; *Tsosie*, 791 F. Supp. 2d at 1107; Fed. R. Evid. 702, advisory committee's notes, 2000 amendments. Generally, expert testimony based on independent research is considered more reliable than testimony prepared for litigation; however, one exception to this rule applies to forensic sciences such as "[f]ingerprint analysis, voice recognition, DNA . . . and a variety of other endeavors closely tied to law enforcement [that] may indeed have the courtroom as a principle theatre of operations." *Daubert II*, 43 F. 3d at 1317, n.5.

¶48 The record reflects that retrograde extrapolation is a forensic science primarily used to establish a person's BAC for the purpose of criminal DUI prosecution.[7] We note, however, that the theory and methodology of retrograde extrapolation has undergone a great deal of testing and study outside the courtroom. As a result, we conclude this factor does not weigh strongly either for or against the reliability of Musselman's testimony.

7. Reliability of Discipline/Determinations by Other Courts

---

[7] We are unable to conclude from this record whether the science of retrograde extrapolation has a non-judicial use or purpose. Fed. R. Evid. 702, advisory committee's notes, 2000 amendments. Similarly, because retrograde extrapolation appears to primarily be a forensic science, another potential Rule 702(c) factor - whether the expert exercises the same degree of care in his litigation testimony as he does in his regular, non-litigation work - is not a relevant factor in this case. *Id*.

¶49 Another factor is whether the expert's field of expertise is known to reach reliable results. Fed. R. Evid. 702, advisory committee's notes, 2000 amendments; *see Kumho Tire*, 526 U.S. at 151 (*Daubert's* general acceptance factor does not help to show reliability where the expert's discipline lacks reliability). In conjunction with this factor, courts have examined whether an expert's technique or methodology has been found to be reliable by other courts. *Olson v. Ford Motor Co.*, 481 F.3d 619, 628 (8th Cir. 2007); *see Senior*, 744 N.E.2d at 620 (In determining that retrograde extrapolation is reliable expert testimony under *Daubert*, the court relied, in part, upon the fact that "[s]everal other jurisdictions have admitted similar evidence."); *State v. Burgess*, 5 A.3d 911, 916-17 (Vt. 2010) (same).

¶50 The State emphasizes that Arizona courts have recognized the utility and admissibility of retrograde extrapolation for many years. *See, e.g.*, *State v. Stanley*, 217 Ariz. 253, 258, ¶ 24, 172 P.3d 848, 853 (App. 2007) (stating that an expert "must use retroactive extrapolation to determine blood alcohol content" if the defendant's blood sample is drawn more than two hours after driving); *Claybrook*, 193 Ariz. at 590, ¶ 15, 975 P.2d at 1103 ("The scientific community has generally accepted" retrograde extrapolation); *Ring*, 141 Ariz. at 69, n.6, 685 P.2d at 134, n.6 (stating that retrograde extrapolation has "achieved general acceptance in the scientific field"). However, none of the Arizona cases cited by the State specifically addresses the reliability of the methodology used by Musselman.

¶51 Several courts from other jurisdictions have found the methodology used by Musselman to be reliable. *Tsosie*, 791 F. Supp. 2d at 1115-16 (holding that retrograde analysis to time of test is a reliable methodology, where, in the absence of information about the defendant's eating and drinking history, an expert relies upon reasonable assumptions as to the average absorption and elimination rates of the general population); *Burgess*, 5 A.3d at 916-17 (retrograde analysis to the time of test is a reliable methodology despite the absence of information about the defendant's eating and drinking history; while such information "would undoubtedly make for a more accurate analysis, that is an issue that goes to the weight of the evidence" and not its admissibility); *Senior,* 744 N.E.2d at 620-21 (stating that retrograde analysis based on average absorption and elimination rates is reliable).

¶52 However, as noted earlier, the trial court and Defendant rely upon *State v. Armstrong*, 267 P.3d 777 (Nev. 2011), for the proposition that retrograde extrapolation is unreliable if it is insufficiently tied to the

drinking and eating history of a defendant. We conclude that *Armstrong* is not persuasive authority for three reasons. First, Nevada has not adopted the *Daubert* standard, and as a result *Armstrong* did not determine the admissibility of retrograde analysis under a standard comparable to Arizona Evidence Rule 702. *Id*. at 780-81. Rather, *Armstrong* analyzed the admissibility of the proffered expert's testimony using the relevance and prejudice standards of Rules 401 and 403. *Id*. Second, the retrograde analysis excluded in *Armstrong* was used to calculate defendant's BAC at the time of driving, and not the time of the test – something even Musselman conceded could not be done accurately without Defendant's eating and drinking history.[8] *Armstrong*, 277 P.3d at 779.

¶53 Third, *Armstrong* relied upon the analysis used by the Texas Court of Criminal Appeals in *Mata v. State*, 46 S.W.3d 902 (Tex. Crim. App. 2001), a case we find readily distinguishable. Like *Armstrong*, *Mata* analyzed the use of retrograde analysis to determine a defendant's BAC at the time of driving, rather than the time of the test. *Mata*, 46 S.W.3d at 905, 908-09, 913. The *Mata* court stated that it was not addressing "whether test results showing a defendant's BAC at some time after the alleged offense are admissible at trial in the absence of retrograde extrapolation." *Id.* at 910. Moreover, the decision in *Mata* was based on Texas' clear and convincing standard for proving the admissibility of expert testimony, rather than the preponderance standard used in Arizona. *Id.* at 908, 917. Finally, many of the concerns of the *Mata* court were based on specific problems with the State's expert and his ability to explain his methodology, a problem that is not present in the instant case. *Id.* at 914-16.

¶54 Accordingly, we conclude that (1) retrograde analysis is generally considered to be a reliable scientific discipline, and (2) courts that have considered the methodology used by the State's expert have determined that it is reliable.

B. Rule 702(d) Factors

---

[8] Although Nevada has a per se DUI statute that defines DUI as having a BAC .08 or greater within two hours of driving, the defendant in *Armstrong* was not charged with that offense. *Armstrong*, 277 P.3d at 779 & n.1; *see* Nevada Revised Statutes ("N.R.S.") section 484C.430(1)(c) (2011) (stating that a person commits the offense of driving under the influence causing death and/or substantial bodily harm if they have a BAC of .08 or greater within two hours of driving).

1. Obvious Alternative Explanations

¶55 In considering the reliability of a methodology as applied to a particular case, courts will examine whether the expert "has adequately accounted for obvious alternative explanations." Fed. R. Evid. 702, advisory committee's note, 2000 amendments. The mere existence or possibility of an alternative explanation does not render an opinion or theory inadmissible; rather, it is sufficient if the expert has at least considered the alternative explanation, and has ruled it out in reaching his opinion. *Id.*; *Tsosie*, 791 F. Supp. 2d at 1114.

¶56 Our review of the record shows that Musselman adequately accounted for obvious alternative explanations in reaching his opinion. Musselman considered the effect Defendant's eating and drinking history would have had on her BAC, including a scenario where Defendant may have consumed a large amount of alcohol immediately before the traffic stop. Musselman also considered whether his retrograde extrapolation produced an artificially high BAC based on the possibility Defendant was not fully absorbed within two hours of driving. Musselman adequately accounted for this possibility by basing his retrograde analysis on conservative absorption and elimination rates, as well as providing a range for Defendant's BAC rather than a specific value. *See supra*, ¶¶ 40-44.

2. Adequately Accounting for Unknown Variables

¶57 The trial court determined that Musselman's testimony was unreliable because he (1) failed to take into account the "unknown variables" of Defendant's drinking and eating history, and (2) he did not give "the defendant the benefit of the doubt" as to these unknown variables. We disagree.

¶58 First, Musselman did have some information about Defendant's eating and drinking history; he knew that Defendant's last drink was before 2:20 a.m., and that Defendant did not eat any significant amount of food after that time. *See supra*, ¶ 10. Second, Musselman accounted for his lack of additional information about Defendant's eating and drinking history by using reasonable assumptions based on average absorption and elimination rates. *See supra*, ¶ 43. Third, all of the assumptions used by Musselman, as well as the range of Defendant's BAC, were based on conservative estimates that erred in favor of Defendant, e.g., calculated a lower BAC for Defendant. *See supra*, ¶ 43.

¶59 Based upon our analysis of the relevant factors under Rule 702, subsections (c) and (d), we conclude that Musselman's retrograde extrapolation methodology was reliable, and that he reliably applied this methodology to the facts of this case. As a result, his retrograde extrapolation testimony is admissible, and the trial court erred in precluding it under Arizona Evidence Rule 702.

C. Rule 403 Balancing

¶60 The trial court determined that because Musselman's retrograde analysis was unreliable and inadmissible under Arizona Evidence Rule 702, its probative worth was substantially outweighed by its danger for unfair prejudice. Ariz. R. Evid. 403. We disagree. Musselman's testimony is reliable under Rule 702, and therefore there is no danger of unfair prejudice. As a result, the trial court erred in precluding his testimony under Rule 403.

Conclusion

¶61 For the foregoing reasons, we grant relief and vacate the trial court's order precluding the State's expert from testifying that, based on his retrograde extrapolation, Defendant's blood alcohol concentration was above the legal limit within two hours of driving. In addition, the stay previously issued in this matter is vacated.

Ruth A. Willingham · Clerk of the Court
FILED: MJT